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(12) # EUROPEAN PATENT APPLICATION

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(54) **Vibrating plate compactor.**

(57) The invention relates to a hand-operated forward-reverse vibrating plate compactor, the vibrating element of which consists of two contra-rotating eccentrics. The vibrational force generated by the eccentrics is directional, forward and reverse motion of the vibrating plate compactor being achieved by changing the phase position of the eccentrics relative to each other. According to the invention, this is accomplished steplessly by means of a hydraulic servo control system through which continuously variable adjustment of the speed and action-in-depth of the vibrating plate compactor can be achieved.

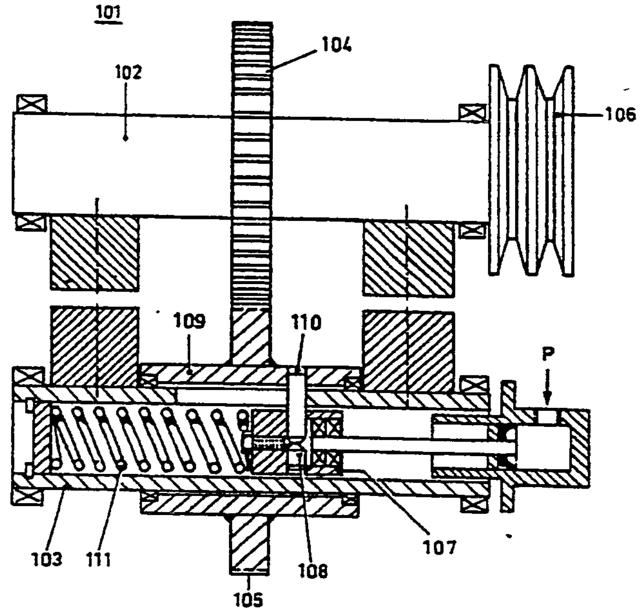

Fig.1

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Vibrating plate compactor

The present invention relates to a hand-operated forward-reverse vibrating plate compactor on which forward and reverse motion is controlled hydraulically by means of a hydraulic servo circuit.

In previously known vibrating plate compactors of the type in question, see for example DE-OS 32 40 626, the eccentric element consists of two contra-rotating eccentric shafts, the phase position of which relative to each other is changed by means of a hydraulic system. On changing the phase position, the direction of the vibrational force is also changed and with it the direction of the vibrating plate compactor's translational motion. The eccentric shafts are rotatably joined by means of gears so that when in rotation the shafts always endeavour to assume a definite phase position relative to each other. In this position a centrifugal force is generated in a definite direction and as a rule the system of controlling the eccentric shafts is so arranged that a forward motion is imparted to the plate compactor at one of the end positions of the system.

Resetting the eccentrics to a position different to the one they endeavour to assume requires a comparatively powerful adjusting force, especially in the case of large eccentric elements. In the known design this is accomplished by means of a hydraulic servo system so that the operating force applied to the forward-reverse control can be disregarded. The phase position of the eccentric shafts relative to each other is controlled by means of a hydraulic piston which is arranged to move axially inside one of the tubular eccentric shafts and which, by means of a pin fastened to it and running in a spiral groove, causes the tubular eccentric shaft to revolve when the piston is moved in an axial direction. In the known design the spiral groove is so arranged that the piston can be moved to two end positions where the vibrational force generated by the eccentrics imparts to the vibrating plate compactor a maximal forward and reverse motion respectively. Even though the servo circuit reduces the force required for adjustment at the control lever, the lever must be held in the position corresponding to reverse motion since the moment of force from the rotating eccentrics would otherwise force them to assume a position corresponding to forward motion of the plate compactor.

The purpose of the present invention is to achieve a vibrating plate compactor with stepless adjustment of the position of the eccentrics relative to each other, thus making it possible to vary the speed of the plate compactor when in forward or reverse motion and to maintain this speed without requiring the control lever to be held in the appropriate position by the operator. In addition, adjustment of the position of the eccentrics to produce a vertically directed vibrational force is rendered possible, which is advantageous if it is desired to increase the depth of compaction in any area, such as close beside a wall.

In the following, the invention will be described in greater detail with reference to the appended drawings, in which Fig. 1 shows a vertical cross-section through an eccentric element for stepless adjustment of the relative positions of the eccentrics forming part of the element. Fig. 2 shows a schematic diagram of the hydraulic system of adjustment according to the invention.

An example of an eccentric element 101 for generating directional vibration is shown in Fig. 1. Eccentric shafts 102 and 103 are rotatably connected to each other by gears 104 and 105. This arrangement causes the eccentric shafts to rotate in opposite directions. The rotational motion of eccentric shaft 102 and with it shaft 103 is imparted by V-belt pulley 106 which is driven from the engine of the vibrating plate compactor.

Eccentric shaft 103 is tubular and capable of turning relative to shaft 102, whereby the phase positions of the eccentric shafts relative to each other can be changed and with it the direction of the vibrational force. Turning of eccentric shaft 103 is accomplished hydraulically by means of a hydraulic piston 107 in which a pin 108 is rigidly mounted at right angles to it and arranged to slide in a spiral groove 110 cut in sleeve 109. Mounted inside shaft 103 at the rear of piston 107 is a spring 111 the purpose of which is to press the piston, when it is not actuated by oil pressure, to one of its end positions, ie when pin 108 comes into contact with one of the end positions of spiral groove 110.

Sleeve 109 is rigidly secured to gear 105, which together with sleeve 109 is mounted so as to be capable of turning on shaft 103. The turning motion is transmitted from shaft 102 to 103 by pin 108.

The hydraulic schematic shown in Fig. 2 consist of a pump 1, which is driven directly by one of the eccentric element's eccentric shafts. The pump is in communication with an oil tank 2 and pumps oil via line 3 to three-way valve 4 having positions F, O and B. By means of a control lever 5, line 3 can be connected to an outgoing line 6 which via the connection P, see Figs. 1 and 2, connects three-way valve 4 with the hydraulic piston 7 (this piston is designated 107 in Fig. 1) used for setting the position of the eccentrics.

By setting control lever 5 to position F, piston 7 is connected to pump 1 and the piston is moved in an axial direction, with adjustment of the eccentrics as a result, to a setting that corresponds to full speed in a forward direction. Connected in the line between piston 7 and three-way valve 4 is a throttle valve 4 and parallel with it a non-return valve 9. In position F, connection between pump and piston is via non-return valve 9.

Control lever 5 is spring-loaded and as soon as it is released returns automatically to a neutral position O, in which position oil is pumped round to the tank and the return line from piston 7 is blocked.

On connection of piston 7 to pump 1 the piston is moved comparatively slowly to its end position due to the counterforce exerted on piston 7 by spring 111, see Fig. 1. The duration of this movement is determined by the size of pump 1, the preset pump pressure and the size of spring 111.

By actuating lever 5 briefly by means of a short, sharp blow and then releasing it so that it returns to the neutral position, piston 7 is caused to move only a short distance, resulting in forward motion of the plate compactor at reduced speed.

If piston 7 is in the position for forward motion and lever 5 is set to position B for reverse motion, piston 7 will be connected to tank 2. The force exerted by spring 111 (Fig. 1) moves the piston in a downward direction on the drawing (Fig. 2) and oil is pressed from piston to tank. However, non-return valve 9 does not allow any oil to pass in this direction but forces the oil to pass through throttle valve 8, with the result that the return movement of the piston takes place at reduced speed. The throttle valve is in this context of such dimensions that the speed of piston 7 is the same in both directions of movement.

Control lever 5 returns to neutral position O from position F and position B alike. In consequence, if it is desired to reverse the plate compactor at reduced speed it is only necessary to actuate lever 5 briefly by means of a short, sharp blow, following which it will return to the neutral position.

The hydraulic adjusting system according to the invention presupposes a continuously variable eccentric element. This allows the vibrating plate compactor to be given a continuously variable translatory motion from zero to maximum speed both forward and in reverse as well as a stationary vibratory motion in which case the direction of the vibrational force is vertical.

In theory it is of course possible with the known design of eccentric adjusting device to hold the control lever in a position between the two end positions of the spiral groove. In practice, however, this is impossible on account of vibration in the lever, at least if it is desired to keep the lever in the same position the whole time.

Claims

1. A hand-operated forward-reverse vibrating plate compactor equipped with a vibrating element embracing two contra-rotating eccentric shafts, the phase positions of which relative to each other are continuously variable by means of a hydraulic servo circuit embracing an oil pump, an oil tank and a piston capable of moving in an axial direction inside a compression cylinder whereby the phase position of the eccentric shafts relative to each other will be changed characterised by
-a throttle valve (8) forming a part of the hydraulic circuit and connected between the movable piston (7,107) and the hydraulic pump (1)
-a multi-way valve (4) likewise forming a part of the hydraulic circuit for connecting the hydraulic pump (1) and the hydraulic tank (2) to the piston (7,107) causing the plate compactor to move in a forward or reverse direction as desired, which multi-way valve (4) has three engagement positions, one for forward motion (F), one for reverse motion (B) and a neutral position (O) in which oil is pumped round to the tank (2) and the return line from the piston (7,107) is blocked and
-a spring-loaded control lever (5) interacting with the multi-way valve (4) whose spring is so dimensioned that the lever (5) when not actuated always returns to the neutral position (O) of the multi-way valve (4) without the piston (7,107) leaving its set position.

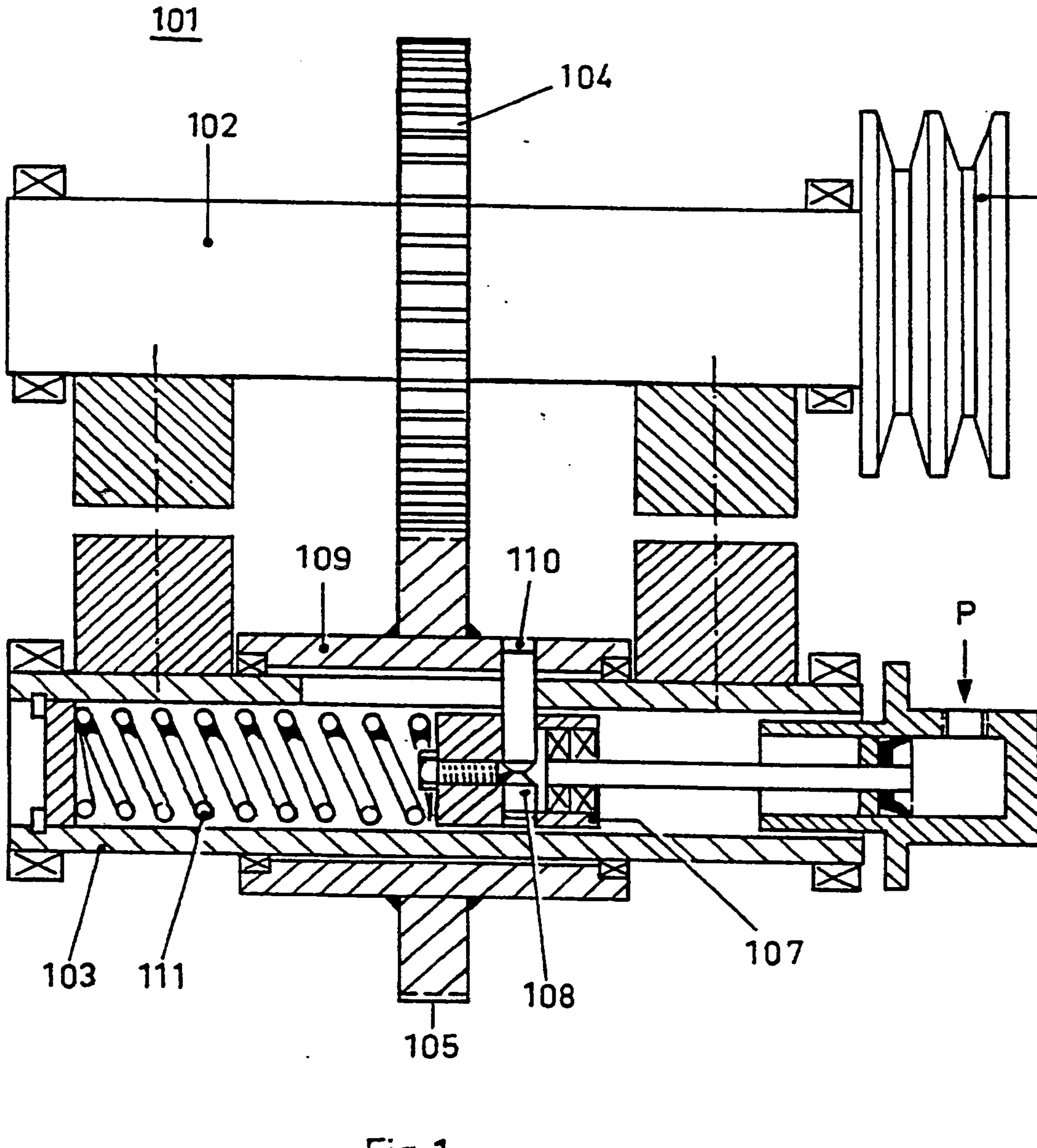

Fig.1

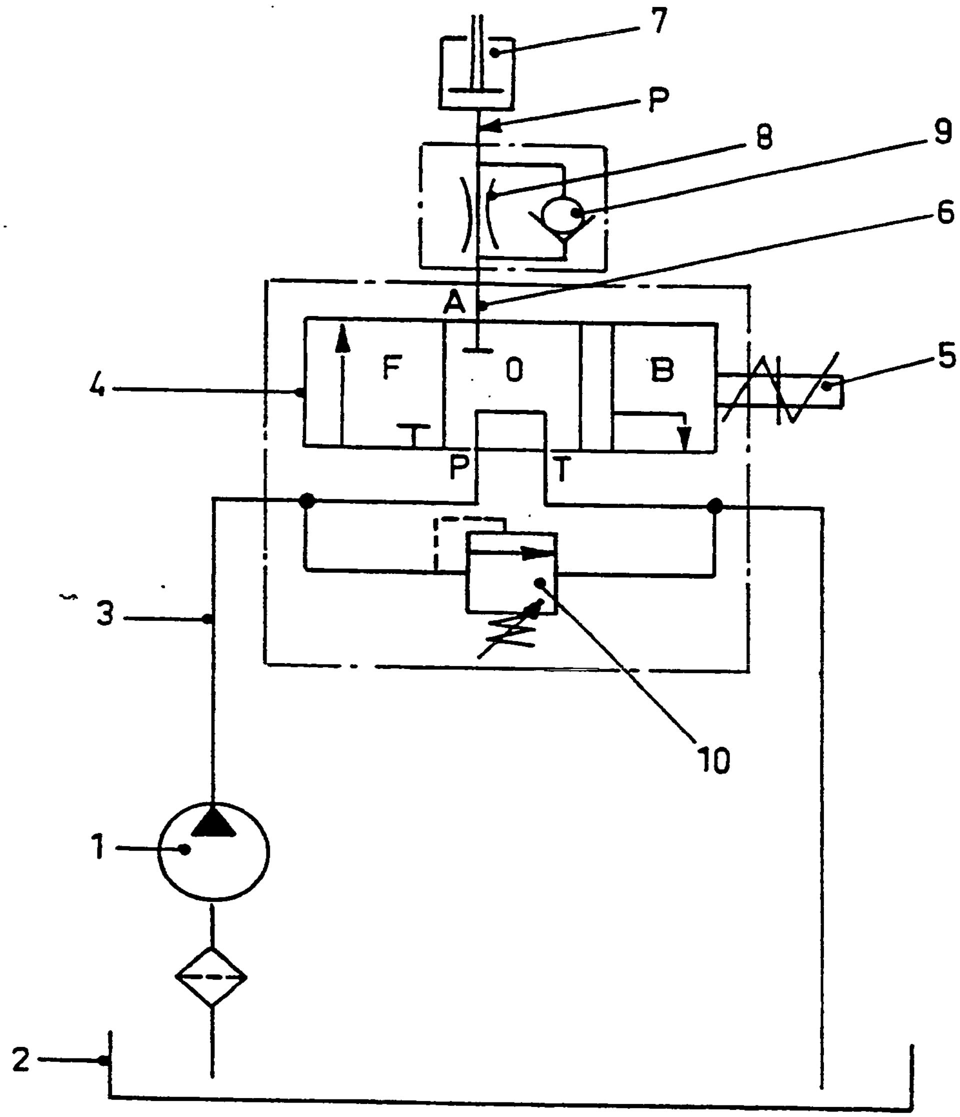

Fig. 2

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EUROPEAN SEARCH REPORT

Application number

EP 87108830.8

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	SE-B- 394 823 (CLARK EQUIPMENT COMPANY) ---	1	E 02 D 3/074 E 01 C 19/38
A	SE-B- 443 387 (VIPAC VIBRATOR AB) * Detail 74 * ---	1	
A	SE-B- 443 591 (DYNAPAC AB) ---	1	
A	DE-A1-3 014 534 (WEBER MASCHINEN TECHNIK BMGH) ---	1	
A,D	DE-A1-3 240 626 (WACKER-WERKE GMBH) ---	1	
A	AT-B- 375 845 (SCHMÖLZER M) * Page 3, lines 4-42 * ---	1	
A	US-A-2 930 244 (HUTCHINSON et al) ---	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 01 C
E 02 D
B 06 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	08-09-1987	NYLUND Ö.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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